California Energy Commission

FINAL REPORT

Replacement of Existing Compressed Natural Gas Infrastructure

Kings Canyon Unified School District

August 2016 | CEC-600-2016-006

Prepared by:

Jason Flores
Shaun L. Rodriguez
Primary Authors

Kings Canyon Unified School District
675 W. Manning Ave.
Reedley, CA 93654
Phone: 559-305-7069

Agreement Number: ARV-13-009

Prepared for:
California Energy Commission

Marc Perry
Agreement Manager
EMERGING FUELS AND TECHNOLOGIES OFFICE

John Butler
Office Manager
ZERO EMISSION VEHICLE AND INFRASTRUCTURE OFFICE

John Y. Kato
Deputy Director
FUELS AND TRANSPORTATION DIVISION

Robert P. Oglesby
Executive Director

PREFACE

Assembly Bill (AB) 118 (Nùñez, Chapter 750, Statutes of 2007), created the Alternative and Renewable Fuel and Vehicle Technology Program (ARFVTP). The statute authorizes the California Energy Commission (Energy Commission) to develop and deploy alternative and renewable fuels and advanced transportation technologies to help attain the state's climate change policies. Assembly Bill 8 (Perea, Chapter 401, Statutes of 2013) reauthorizes the ARFVTP through January 1, 2024.

The ARFVTP has an annual budget of around $100 million and provides financial support for projects that:

- Reduce California's use of and dependence on petroleum transportation fuels and increase the use of alternative and renewable fuels and advanced vehicle technologies.
- Produce sustainable alternative and renewable low-carbon fuels in California.
- Expand alternative fueling infrastructure and fueling stations.
- Improve the efficiency, performance, and market viability of alternative light-, medium-, and heavy-duty vehicle technologies.
- Retrofit medium- and heavy-duty on-road and off-road vehicle fleets to alternative technologies or fuel use.
- Expand the alternative fueling infrastructure available to existing fleets, public transit, and transportation corridors.
- Establish workforce training programs and conduct public outreach on the benefits of alternative transportation fuels and vehicle technologies.

The California Energy Commission issued solicitation PON-12-605 to provide funding opportunities under the ARFVTP for projects to support installation of new natural gas fueling infrastructure and upgrades to existing natural gas fueling infrastructure. To be eligible under PON-12-605, the project must also be consistent with the Energy Commission's Investment Plan. In response to PON-12-605, Kings Canyon Unified School District submitted Proposal 12, which was proposed for funding in the Energy Commission's August 2, 2013, revised notice of proposed awards. The Energy Commission accepted the district's proposal under Grant Agreement ARV-13-009, and construction began on the compressed natural gas fueling infrastructure.

ABSTRACT

The California Energy Commission's Alternative and Renewable Fuel and Vehicle Technology Program awarded the Kings Canyon Unified School District $300,000 to replace and upgrade its compressed natural gas fueling system.

This final project report documents the planning, budget, specifications, and initial throughput for the upgraded fueling station. The appendix specifies the replaced and installed equipment in photographs.

Keywords: California Energy Commission, Kings Canyon Unified School District, Alternative and Renewable Fuel and Vehicle Technologies Program, natural gas fueling station, compressed natural gas

Please use the following citation for this report:

Flores, Jason, Shaun L. Rodriguez. (Kings Canyon Unified School District). 2016. ***Replacement of Existing Compressed Natural Gas Infrastructure – Kings Canyon Unified School District.*** California Energy Commission. Publication Number: CEC-600-2016 -006.

TABLE OF CONTENTS

LIST OF TABLES

Page

LIST OF FIGURES

Page

EXECUTIVE SUMMARY

The Kings Canyon Unified School District, in an effort to support California air quality and climate change goals, has committed to converting its fleet of school buses and other vehicles to those using compressed natural gas. The district purchased its original compressed natural gas fueling infrastructure in 1996; however, that equipment has since reached the end of the serviceable life. The district applied for and was awarded a $300,000 grant from the California Energy Commission's Alternative and Renewable Fuels and Vehicle Technologies Program to replace the existing, out-of-date fueling equipment with new, state-of-the-art infrastructure to increase station reliability and throughput.

The new infrastructure includes a compressed natural gas dryer to remove water from the natural gas before it is compressed, a valve panel time-fill control to determine the priority and sequence of flow of compressed natural gas from the compressor the dispensers, a stand-alone fuel dispenser, and technology that alerts the mechanics when there is a breakdown, a power outage, or other such incidents that cause the infrastructure to stop working. These improvements allow the district to store compressed natural gas at a pressure of 14,500 pounds per square inch and fuel vehicles at a rate of 140 cubic feet per minute.

Furthermore, the infrastructure will be available during business hours to other local school bus fleets, the City of Reedley municipal vehicles, Pacific Gas and Electric Company, other vehicle fleets, and the public for fueling. The authors estimate that the district's new equipment will displace nearly 167,000 gallons of gasoline per year with comparable amounts of compressed natural gas, with accompanying greenhouse gas emission reductions.

Problem Statement

The San Joaquin Valley, in general, and the Fresno Metropolitan Area, specifically, has such poor air quality that it consistently ranks in the top five in nationwide “most polluted” studies. The Kings Canyon Unified School District in Reedley, California, is in the heart of Fresno County and has worked aggressively to reduce air pollution in the San Joaquin Valley by replacing diesel powered buses with those that are powered by compressed natural gas (CNG). The district has 25 CNG-powered buses and 5 CNG-powered service vehicles. Because of the costs the infrastructure places upon the district, the district has opened the CNG station to other agencies and the public to relieve the financial burden. The existing compressor and associated fueling equipment are 20 years old and need replacement due to constant use and age. The California Energy Commission grant was necessary to continue providing CNG for the district's transportation fleet and the various community organizations that use the fueling station.

Goal of the Agreement

This project sought to replace the existing, out-of-date CNG infrastructure with new, state-of-the-art equipment. Previously, the nearest publicly available CNG stations were more than 25 miles away in Visalia and Fresno. The new infrastructure will reduce the miles traveled for CNG fuel and will be available to other school bus fleets, City of Reedley municipal vehicles, Pacific Gas and Electric Company, other fleets, and the public.

Project Planning, Approach, and Process

The district, in consultation with Fuel Solutions, Inc., developed specifications for the project, created the bid proposal, conducted inspections, and provided technical expertise in CNG and CNG facilities. The district formally announced that it would start accepting bids on March 17, 2015, for contractors to partner in the district’s proposal for the Energy Commission’s Alternative and Renewable Fuel and Vehicle Technology Program (ARFVTP) funding solicitation PON-12-605 (“Compressed Natural Gas Fueling Infrastructure”). The bid was for the procurement and installation of a new compressor and fast-fill dispenser and was awarded to Revolution CNG of Paso Robles. The new equipment selected was a Bauer compressor Model C23.2 M-Series duplex unit with a discharge-type CNG dryer, priority valve panel time-fill control with remote communication, and a Tulsa Gas Technologies twin high hose stand-alone CNG dispenser.

The project started June 15, 2015, with the replacement of the old compressor equipment with a new compressor. Once the compressor was stationed, installation of new wiring and piping began immediately. Re-piping, electrical wiring, and startup were completed on June 22, 2015, with minor adjustments needed once the equipment ran.

The new fast-fill dispenser was delivered August 7, 2015. Installation began August 12, 2015, and was completed August 14, 2015.

On September 3, 2015, Fuel Solutions inspected the new CNG fueling infrastructure and signed off on project completion December 8, 2015.

Maximum Capacity of the New Fueling System

The new station has a capacity of 14,500 psi CNG storage. The Bauer C23 M-Series Model C23.2 can handle a capacity of 140 cubic feet per minute, nearly doubling the output from the older compressors. The new infrastructure has the same horsepower as the older equipment and is getting 40 percent more throughput.

Economic Benefits

This project occurred in an economically disadvantaged area of the state and supported temporary construction employment for about two months. Furthermore, the district anticipates state and local revenues of around $29,354 per year, based on sales taxes from other fleets and public users.

Table 1 summarizes the budget for this project. The cost of the replacement was $403,238.00, which was $103,238.00 above the amount of the ARFVTP grant. This overage was funded by the agreement match share ($69,128) and additional cash on hand.

Table 1: Project Budget

Task		ARFVTP Grant	Match Share	Task Total
1	Administration	$9,568	-	$9,568
2	Engineering and Design	$14,000	-	$14,000
3	CNG Equipment Procurement	$237,188	$69,128	$306,316
4	CNG Equipment Delivered and Installed	$39,000	-	$39,000
5	CNG Station Startup and Commissioning	$244	-	$244
6	Data Collection and Analysis	-	-	-
	TOTAL	**$300,000**	**$69,128**	**$369,128**

Source: Kings Canyon Unified School District

Number of Vehicles Fueled, Station Usage, and Benefits

The station has operated most of the time. Over a six-month period, there were only two inoperative days, which included downtime that resulted from fine-tuning of the new compressor.

The district has 25 CNG buses and 5 service vehicles that conduct slow fills overnight and fast fills during the day. In addition to the district vehicles, the City of Reedley transit has 7 CNG refuse trucks, Immanuel Schools has 4 CNG buses, AT&T has 10 CNG vans, Orange Cove Transit has 4 CNG transit buses, and Fresno Rural Transit has 12 CNG buses. Dinuba Unified occasionally fuels the 2 CNG buses it possesses and will use the facility for its anticipated 16 new CNG buses.

On average, 31 vehicles fuel at the station each day. The station averages 2 public vehicle usages per day and 33 fleet vehicle usages per day. The former represents about 20 gasoline

gallons equivalent (GGE) per day and the latter represents about 374 GGE per day. Averaged over a year, this number represents an annual petroleum displacement of roughly 91,900 GGE per year per vehicle. Compared to the older equipment, the new equipment increases station reliability and CNG throughput from 78,000 GGE to 166,782 GGE per year, as shown in **Table 1**.

Assuming a carbon content of 2,778 grams per gallon of diesel, this amount equates to the reduction of nearly 510 tons of carbon dioxide per year.

Table 2: Current and Anticipated Public Usage of New CNG Infrastructure

Fleet Owner	Dinuba USD (Current)	Dinuba USD (Anticipated)	City of Reedley	PG&E	Fresno Rural Transit	Orange Cove Transit	Clay Unified School District	Immanuel Schools (Private)	AT&T
Fleet Description	40' CNG School Buses	40' CNG School Buses	CNG Refuse Trucks	1-Ton CNG Service Body Truck	35' CNG Paratransit Buses	35' CNG Paratransit Buses	40' CNG School Buses	40' CNG School Buses	CNG Service Vans
# of Vehicles	2	16	7	3	12	4	1	4	10
Estimated Miles per Day	45	45	70	40	80	80	55	55	50
Estimated Miles per Gallon in GGE**	5.5	5.5	3.0	10.0	5.0	5.0	5.5	5.5	12.0
GGE per Vehicle per Day	8.2	8.2	23.3	4.0	16.0	16.0	10.0	10.0	4.2
Operational Days per Year	200	200	312	250	250	250	175	180	250
Estimated GGE per Fleet per Year	3,273	26,182	50,960	3,000	48,000	16,000	1,750	7,200	10,417
****GGE = Gasoline Gallons Equivalent**						**Total Anticipated GGE per Year**			**166,782**

Source: Kings Canyon Unified School District

Conclusions

This project, funded by ARFVTP Grant Agreement ARV-13-009, has achieved the district's goals. The primary objective was to replace the existing CNG fueling station built in 1996. By working on this project over the summer, school bus downtime was zero and there was no effect on student achievement. The district has made the availability of the CNG station known to private and public entities (**Figure 1**).

Kings Canyon Unified School District has also increased its CNG bus fleet. In the last two years, 6 diesel buses were decommissioned, bringing the number of vehicles in the district fleet to 31 CNG buses. The 6 diesel buses equated to nearly 192,000 diesel miles that have been changed to CNG. In total, the district's CNG fleet of 31 buses travels 334,800 miles per year. With diesel buses running around 7 miles per gallon, the district estimates that these 31 buses will displace 47,829 gallons of diesel fuel per year.

The new technologies also allow district and personal cell phones to receive alerts when there are power outages or other issues. For example, if a power outage prevents buses from being filled overnight, an alert is sent to staff automatically rather than being realized the next morning. This is tremendously valuable, as it saves staff time and allows issues to be addressed without delay.

Appendix: Project Photos

Figures 1-5 depict some of the equipment decommissioned and installed during this project, which includes:

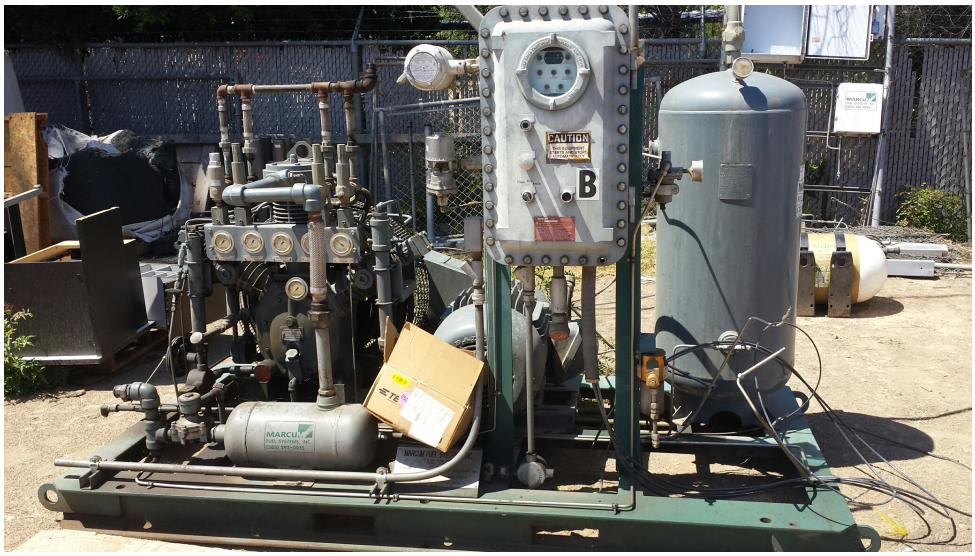
- Decommissioned compressors.
  - **Figure 1**-ANGI Model NG50E
  - **Figure 2**-Ingersoll Rand
- An installed compressor.
  - **Figure 3**-Bauer C23.2 M-Series Duplex
- A decommissioned dispenser.
  - **Figure 4**-Unknown brand of dispenser
- An installed dispenser.
  - **Figure 5**-Tulsa Gas Technologies Twin High Hose Stand Alone

Gaylene Cooper 8/12/16 7:45 AM
Deleted: .

Figure 1: Decommissioned Compressor (ANGI)

Source: Kings Canyon Unified School District

Figure 2: Decommissioned Compressor (Ingersoll Rand)



Source: Kings Canyon Unified School District

Figure 3: New Compressor

Source: Kings Canyon Unified School District

Figure 4: Decommissioned Compressed Natural Gas Dispenser

Source: Kings Canyon Unified School District

Figure 5: New Compressed Natural Gas Dispenser

Source: Kings Canyon Unified School District